

Christoph Heindl

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Summary

I am currently a research scientist at PROFACTOR and until recently I was a doctoral candidate in the Computational Perception group at the Johannes Kepler University of Linz (JKU). I work at the interface of computer vision and robotics with a focus on probabilistic approaches to create optimized training data for machine learning. Recently, I created a widely used real-time 3D reconstruction software called ReconstructMe¹ and initiated several popular open source projects². Both projects are now used by a variety of research groups worldwide, including Facebook, Google, and Microsoft.

Interests. Machine Learning, Computer Vision, and Robotics.

Education

- 2017–2020 **Dr. techn. (with distinction)**, JKU, Linz, Computational Perception.
Visual Perception and Interaction Using Synthetic Data in Manufacturing.
- 2000–2004 **DI(FH)**, FH Upper Austria, Hagenberg, Software Engineering.
Pairwise Registration of 3-D Range Data: Analysis and Evaluation of Modern Algorithms

Experience

My professional work experience as a full-time researcher.

- 2016–now **Scientist**, PROFACTOR GmbH, Steyr.
Machine Learning for Visual Computing
- 2008–2016 **Senior Research Engineer**, PROFACTOR GmbH, Steyr.
Robotics and Adaptive Systems
- 2004–2008 **Research Engineer**, PROFACTOR GmbH, Steyr.
3D Computer Vision

Research Projects

A selection of research projects that I have worked on in the past and for which I partly helped to secure funding.

- 2019–2023 **Medusa**, Innovatives OÖ 2020, 2.000.000€.
Leitprojekt Medizintechnik: Creation of an innovative training and planning platform for neurosurgeons with vision-based behavior documentation.
- 2017–2021 **Lern4MRK**, BMVIT, 2.000.000€.
Learn to map human demonstrations onto collaborative robots.
- 2015–2018 **Autoscan**, FFG, 1.300.000€.
An autonomous sensor system utilizes human activity forecasting for active thermography planning.

¹<https://www.reconstructme.net/>

²<https://github.com/cheind>

- 2015–2017 **SIAM**, FFG, 730.000€.
Seamless interoperability of assistive modules in the digital factory for automated 3D documentation.
- 2013–2017 **NextFactory**, ICT, 4.760.000€.
All-in-one manufacturing platform for system in package and micromechatronic systems.
- 2012–2014 **ShowMe**, FFG, 560.000€.
Assistive system for assembly tasks based spatially correct projections and next step recommendations.
- 2010–2013 **SRS**, ICT, 5.000.000€.
Semi-autonomous robotic solutions in domestic environments for elderly people support.
- 2008–2010 **AHUMARI**, FFG, 400.000€.
Fusing robot programming by demonstration with visual tracking.

Awards

- 2021 Best Demo Honorable Mention (UbiComp2021)
- 2018 2nd place in the classification of acoustic scenes (DCASE2018)
- 2017 Best oral presentation (ICMV2017)
- 2012 enGenius award for our Binpicking system iRobFeeder (BMW)
- 2007 Hagenberg Software Award
- 2006 State Award for Innovation (Landespreis für Innovation)

Patents

- 2020 Calibration method for a projector - Kalibrierverfahren für einen Projektor (AT522320)
- 2017 Apparatus for detecting a three-dimensional model corresponding to the surface of an object - Vorrichtung zum Erfassen eines der Oberfläche eines Objektes entsprechenden dreidimensionalen Modells (AT519447B1)
- 2009 Method for continuously determining a gripping position (WO2011003124A1)

Miscellaneous

- 2019 Host of Workshop (OAGM2019)
- 2019 Reviewer (IJCAI2019, ICRA2021), Session chair (ETFA2019)
- 2017–2020 Supervised three master students

Publications

- [1] **Christoph Heindl**, Lukas Brunner, Sebastian Zambal, and Josef Scharinger. “BlendTorch: A Real-Time, Adaptive Domain Randomization Library”. In: *1st Workshop on Industrial Machine Learning at International Conference on Pattern Recognition (ICPR2020)*. Milan, Italy: Springer, 2021.
- [2] Thomas Pönitz, Gerhard Ebenhofer, Gernot Stübl, **Christoph Heindl**, and Josef Scharinger. “On the Potential of large-scale Extended Reality Interaction for Industrial Environments”. In: *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2021 ACM International Symposium on Wearable Computers*. Best Demo Honorable Mention. Virtual Conference: ACM, 2021.
- [7] **Christoph Heindl**, Markus Ikeda, Gernot Stübl, Andreas Pichler, and Josef Scharinger. “Enhanced Human-Machine Interaction by Combining Proximity Sensing with Global Per-

ception". In: *2nd Workshop on Proximity Perception in Robotics at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. KITopen, 2019.

- [10] **Christoph Heindl**, Gernot Stübl, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. "Visual Large-scale Industrial Interaction Processing". In: *Adjunct Proceedings of the ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2019 ACM International Symposium on Wearable Computers*. London, United Kingdom: ACM, 2019, pp. 280–283. ISBN: 978-1-4503-6869-8.
- [11] **Christoph Heindl**, Sebastian Zambal, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. "3D Robot Pose Estimation from 2D Images". In: *Proceedings of the International Conference on Digital Image & Signal Processing (DISP)*. Corgascience Oxford, 2019. ISBN: 978-1-912532-05-6.
- [12] **Christoph Heindl**, Sebastian Zambal, and Josef Scharinger. "Learning to Predict Robot Keypoints Using Artificially Generated Images". In: *24th IEEE International Conference on Emerging Technologies and Factory Automation (ETFA)*. IEEE, 2019, pp. 1536–1539. ISBN: 978-1-7281-0303-7.
- [14] Thomas Pönitz, **Christoph Heindl**, Andreas Pichler, and Martin Kampel. "Automatic Intrinsic and Extrinsic Projector Calibration with Embedded Light Sensors". In: *Proceedings of the Joint ARW & OAGM Workshop 2019*. OAGM & GMAR. Verlag der Technischen Universität Graz, 2019, pp. 193–194. ISBN: 978-3-85125-663-5.
- [15] Sebastian Zambal, **Christoph Heindl**, and Christian Eitzinger. "Machine Learning for CFRP Quality Control". In: *Conference of the Society for the Advancement of Material and Process Engineering (SAMPE)*. Nantes, France: SAMPE, 2019.
- [16] Sebastian Zambal, **Christoph Heindl**, and Christian Eitzinger. "Probabilistic Modelling combined with a CNN for boundary detection of carbon fiber fabrics". In: *IEEE 17th International Conference on Industrial Informatics (INDIN)*. IEEE, 2019, pp. 1621–1626. ISBN: 978-1-7281-2927-3.
- [17] Sebastian Zambal, **Christoph Heindl**, Christian Eitzinger, and Josef Scharinger. "End-to-end defect detection in automated fiber placement based on artificially generated data". In: *Fourteenth International Conference on Quality Control by Artificial Vision*. International Society for Optics and Photonics. SPIE, 2019, pp. 371–378. ISBN: 978-1-5106-3054-3.
- [21] **Christoph Heindl**, Thomas Pönitz, Andreas Pichler, and Josef Scharinger. "Large Area 3D Human Pose Detection Via Stereo Reconstruction in Panoramic Cameras". In: *Proceedings of the OAGM Workshop*. Austrian Association of Pattern Recognition. Verlag der Technischen Universität Graz, 2018, pp. 103–110.
- [24] **Christoph Heindl**, Thomas Pönitz, Gernot Stübl, Andreas Pichler, and Josef Scharinger. "Spatio-thermal depth correction of RGB-D sensors based on Gaussian processes in real-time". In: *Tenth International Conference on Machine Vision (ICMV)*. Vol. 10696. International Society for Optics and Photonics. SPIE, 2018, pp. 333–340.
- [26] Gernot Stübl, **Christoph Heindl**, Harald Bauer, and Andreas Pichler. "On Quality Assurance of 3D Bust Reconstructions". In: *Proceedings of the 2nd OAGM-ARW Joint Workshop Vision, Automation and Robotics*. 2017.

- [27] Sharath C. Akkaladevi, Martin Ankerl, **Christoph Heindl**, and Andreas Pichler. “Tracking multiple rigid symmetric and non-symmetric objects in real-time using depth data”. In: *IEEE International Conference on Robotics and Automation (ICRA)*. 2016, pp. 5644–5649. ISBN: 978-1-4673-8026-3.
- [30] **Christoph Heindl**, Sharath C. Akkaladevi, and Harald Bauer. “Capturing Photorealistic and Printable 3D Models Using Low-Cost Hardware”. In: *Advances in Visual Computing*. Springer International Publishing, 2016, pp. 507–518. ISBN: 978-3-319-50835-1.
- [31] Sharath C. Akkaladevi and **Christoph Heindl**. “Action Recognition for Human Robot Interaction in Industrial Applications”. In: *IEEE International Conference on Computer Graphics, Vision and Information Security (CGVIS)*. 2015, pp. 94–99. ISBN: 978-1-4673-7437-8.
- [32] **Christoph Heindl**, Harald Bauer, Martin Ankerl, and Andreas Pichler. “ReconstructMe SDK: a C API for Real-time 3D Scanning”. In: *6th International Conference and Exhibition on 3D Body Scanning Technologies*. 2015. ISBN: 978-3-033-05270-3.

Technical Reports and Posters

- [3] **Christoph Heindl**. *Graph Neural Networks for Node-Level Predictions*. 2020. arXiv: 2007.08649 [cs.LG].
- [8] **Christoph Heindl**, Markus Ikeda, Gernot Stübl, Andreas Pichler, and Josef Scharinger. *Metric Pose Estimation for Human-Machine Interaction Using Monocular Vision*. Poster at Workshop on Factory of the Future at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). 2019.
- [9] **Christoph Heindl** and Josef Scharinger. *Notes on Semi-Supervised Expectation Maximization*. 2019. URL: <https://doi.org/10.5281/zenodo.3484301>.
- [18] Matthias Dorfer, Bernhard Lehner, Hamid Eghbal-zadeh, **Christoph Heindl**, Fabian Paischer, and Gerhard Widmer. *Acoustic Scene Classification with Fully Convolutional Neural Networks and I-Vectors*. 2018.